

Claims

1. A process for producing canthaxanthin and echinenone which comprises cultivating a recombinant microorganism which is expressing a  $\beta$ -carotene ketolase gene and belonging to the genus *Xanthophyllomyces* (*Phaffia*) in an aqueous nutrient medium under aerobic conditions, and isolating the resulted carotenoids from the cells of said recombinant microorganism or from the cultured broth.
2. The process according to claim 1, wherein the recombinant microorganism is derived from *Xanthophyllomyces dendrorhous* (*Phaffia rhodozyma*) ATCC96815, or a mutant thereof.
3. The process according to claim 1, wherein the  $\beta$ -carotene ketolase gene is originated from a microorganism which is selected from the group consisting of microorganisms of the genera *Agrobacterium*, *Alcaligenes*, *Paracoccus* and *Haematococcus* having the  $\beta$ -carotene ketolase gene.
4. The process according to claim 1, wherein the  $\beta$ -carotene ketolase gene is originated from a microorganism which is selected from the group consisting of *Agrobacterium aurantiacum*, *Alcaligenes* PC-1, *Paracoccus marcusii* MH1, a gram-negative bacteria E-396 (FERM BP-4283), and *Haematococcus pluvialis*, having the  $\beta$ -carotene ketolase gene.
5. The process according to claim 1, wherein the  $\beta$ -carotene ketolase gene is originated from *Alcaligenes* PC-1 or the DNA sequence of the  $\beta$ -carotene ketolase gene is substantially homologous thereto.
6. The process according to claim 1, wherein the  $\beta$ -carotene ketolase gene is expressed in the recombinant microorganism using the control sequences.
7. The process according to claim 1, wherein the cultivation is carried out at a pH in the range of from 4 to 8 and at a temperature in the range of from 15 to 26°C for 24 to 500 hours.
8. The process according to claim 7, wherein the cultivation is carried out at pH in the range of from 5 to 7 and at a temperature in the range of from 18 to 22°C for 48 to 350 hours.